# LEAD MONITORING STUDY AROUND MASTER METALS INC. AND LTV STEEL COMPANY

by

Mark E. Conti

Cleveland Office
Resource Management Division
U.S. Environmental Protection Agency - Region 5
Westlake, Ohio 44145

January 1996

## ACKNOWLEDGEMENTS

The author thanks Paul Novak and L.J. Lins for their sampling assistance. Marjorie Stys and Yvonne Brazelton reduced wind data and generated wind roses. Will Damico obtained siting waivers and input data to the Air Information Retrieval System. John Morris, Francis Awanya, Vergel Santos, and Kathleen Sluis gave analytical support and assisted with the development of a quality assurance project plan.

## TABLE OF CONTENTS


PREFACE . . . . . 1

INTRODUCTION . . . . . 1
Objective . . . . . 1
Background . . . . . 1
Lead NAAQS Attainment Strategy . . . . . 1
Early Monitoring Results for Master Metals . . . . . 1
Developing a Lead Monitoring Network in the Vicinity of Master Metals and LTV Steel . . . . . 2
FINDINGS . . . . . 2
Sample Results . . . . . 2
Wind Data . . . . . 5

CONCLUSIONS . . . . . 5
Source of Lead Emissions . . . . . 5
Re-entrainment of Lead . . . . . 17
Lead Concentration Gradient . . . . . 17
Reductions in Lead Emissions and Ambient Lead . . . . . 17

LIST OF TABLES
1. Lead Results for Master Metals/LTV Steel Monitoring Study During the First Quarter of 1993 . . . . . 6
2. Lead Results for Master Metals/LTV Steel Monitoring Study During the Second Quarter of 1993 . . . . . 7
3. Lead Results for Master Metals/LTV Steel Monitoring Study During the Third Quarter of 1993 . . . . . 8
4. Lead Results for Master Metals/LTV Steel Monitoring Study During the Fourth Quarter of 1993 . . . . . 9
5. Total Suspended Particulate Results for Master Metals/LTV Steel Monitoring Study During the First Quarter of 1993 . . . . . 10
6. Total Suspended Particulate Results for Master Metals/LTV Steel Monitoring Study During the Second Quarter of 1993 . . . . . 11
7. Total Suspended Particulate Results for Master Metals/LTV Steel Monitoring Study During the Third Quarter of 1993 . . . . . 12
8. Total Suspended Particulate Results for Master Metals/LTV Steel Monitoring Study During the Fourth Quarter of 1993 . . . . . 13
9. Quarterly Lead Results for Master Metals/LTV Monitoring Study . . . . . 14
10. Effect of Wind Direction on Measured Lead Concentrations . . . . . 16
11. Concentration Gradient of Ambient Lead . . . . . 18

LIST OF FIGURES
A. Map of Air Monitoring Network . . . . . 3
B. Map of Study Area and Surrounding Neighborhoods . . . . . 4
C. Graph of Quarterly Lead Results for Master Metals/LTV Monitoring Study . . 15

LIST OF APPENDICES
A. Graphs of Daily Lead Results
B. Wind Roses for Sample Days

## I. PREFACE

The Cleveland Office (formerly Eastern District Office) conducted an ambient air monitoring study in an industrialized area of Cleveland, Ohio from January 9 - December 29, 1993. High-volume air samplers were placed at four locations in the study area to determine the source of high lead emissions that were being measured at another monitoring station in the area. Twenty-four hour samples were collected every third day and analyzed for lead and particulate content.

## II. INTRODUCTION

### A. Objective

The study was conducted to determine whether Master Metals Inc., a secondary lead smelter, was the cause of high lead readings at a monitoring station established at the fence line of the facility's property. The only other sources in the area with a potential to emit lead and contribute to the elevated lead concentrations at the fence line station were two basic oxygen furnaces operated by LTV Steel Company. To verify the source of high ambient lead levels, additional monitors and wind data were needed.

### B. Background

#### 1. Lead NAAQS Attainment Strategy

In 1990, the Office of Air Quality Planning and Standards initiated a lead National Ambient Air Quality Standards (NAAQS) attainment strategy. Twenty-nine stationary sources were originally targeted in the strategy. One piece of the strategy called for the regional offices to establish fence-line and downwind lead monitoring stations at all secondary lead smelters. On January 28, 1991, David Kee, director, Region 5 Air and Radiation Division, sent a Section 114 letter to Douglas Mickey, president, Master Metals, Inc., requesting him to establish and operate lead monitors at the facility's fence-line and downwind of the facility. As a result of the request, one high-volume lead sampler was placed along the eastern edge of Master Metals' property. Another two samplers were co-located about 500 meters north of Master Metals' rotary lead smelting furnaces. The Cleveland Division of Air Pollution Control was contracted by Master Metals to operate the samplers. An independent laboratory was contracted to perform lead analyses.

#### 2. Early Monitoring Results for Master Metals

The Cleveland Division of Air Pollution Control began monitoring lead levels at the newly established stations on January 31, 1992. During the first calendar quarter of 1992, the lead concentration measured at the fence line station was 37.4 $\mu g/m^3$. The concentration during the second calendar quarter was 28.0 $\mu g/m^3$. The concentration during the third calendar quarter was 23.1 $\mu g/m^3$. The NAAQS for lead is 1.5 $\mu g/m^3$ as a quarterly average.

3. Developing a Lead Monitoring Network in the Vicinity of Master Metals and LTV Steel

Upon receiving notice of the high lead concentrations at the fence line station, the Air and Radiation Division decided that a lead monitoring network and a wind measurement station should be established to determine whether Master Metals or other sources were the cause of high lead concentrations in the air. The Eastern District Office was asked to develop and operate the monitoring network. Figure A shows where high-volume TSP/lead samplers and the wind measuring system were located. Figure B shows the location of study area and surrounding neighborhoods.
Site Nos. 1 and 2 were established as fence line stations. Site No. 1 was about 50 degrees (i.e. northeast) and 75 meters from Master Metals' central emission point. The central emission point refers to the point central to the two lead furnaces and baghouse stacks. Site No. 2 was about 200 degrees (i.e. south-southwest) and 70 meters from Master Metals. Site No. 3 was about 220 degrees (i.e. southwest) and 490 meters from Master Metals. Site No. 4 was about 150 degrees (i.e. south-southeast) and 370 meters from Master Metals.

The samplers at Site Nos. 2, 3, and 4 were placed on 4-foot platforms. The inlets of these samplers were 2.4 meters above ground level. The sampler at Site No. 4 was placed on an 8-foot platform. Its inlet was 3.6 meters above ground level. The wind vane was 4.9 meters above ground level and about 8.5 meters above the elevation of Master Metals' property. To the extent possible, the monitors were located so that the siting criteria in 40 CFR Part 58 were met. Where lack of public land and the goals of the study precluded satisfying a siting criterion, waivers were obtained.

The air samples were collected with General Metal Works Model GMWL-2000H high-volume samplers. The wind speed and wind direction were measured with a Belfort Aerovane Model 120 wind transmitter. The wind speed and wind direction were recorded with a Bendix Aerovane Model 141-2 wind recorder. Two samplers were co-located at Site No. 2 to collect quality assurance data. Sample analysis was performed by the Region 5 Central Regional Laboratory.

Specific information about sampling and analysis protocol is given in the quality assurance project plan (QAPP) prepared for the study titled Quality Assurance Project Plan for Establishing a Network of Ambient Monitors around Master Metals Inc. and LTV Steel Company to Measure Lead and Total Suspended Particulate. The QAPP was dated December 21, 1992.

## III. FINDINGS

A. Sample Results

The wind station was put into operation on January 6, 1993, and was operated until December 31, 1993. Ambient air sampling was initiated on January 9, 1993. Air samples were collected at each of the four stations every three days through December 29, 1993. There were 434 samples collected during the study and an additional 108 samples were collected with the co-located sampler for

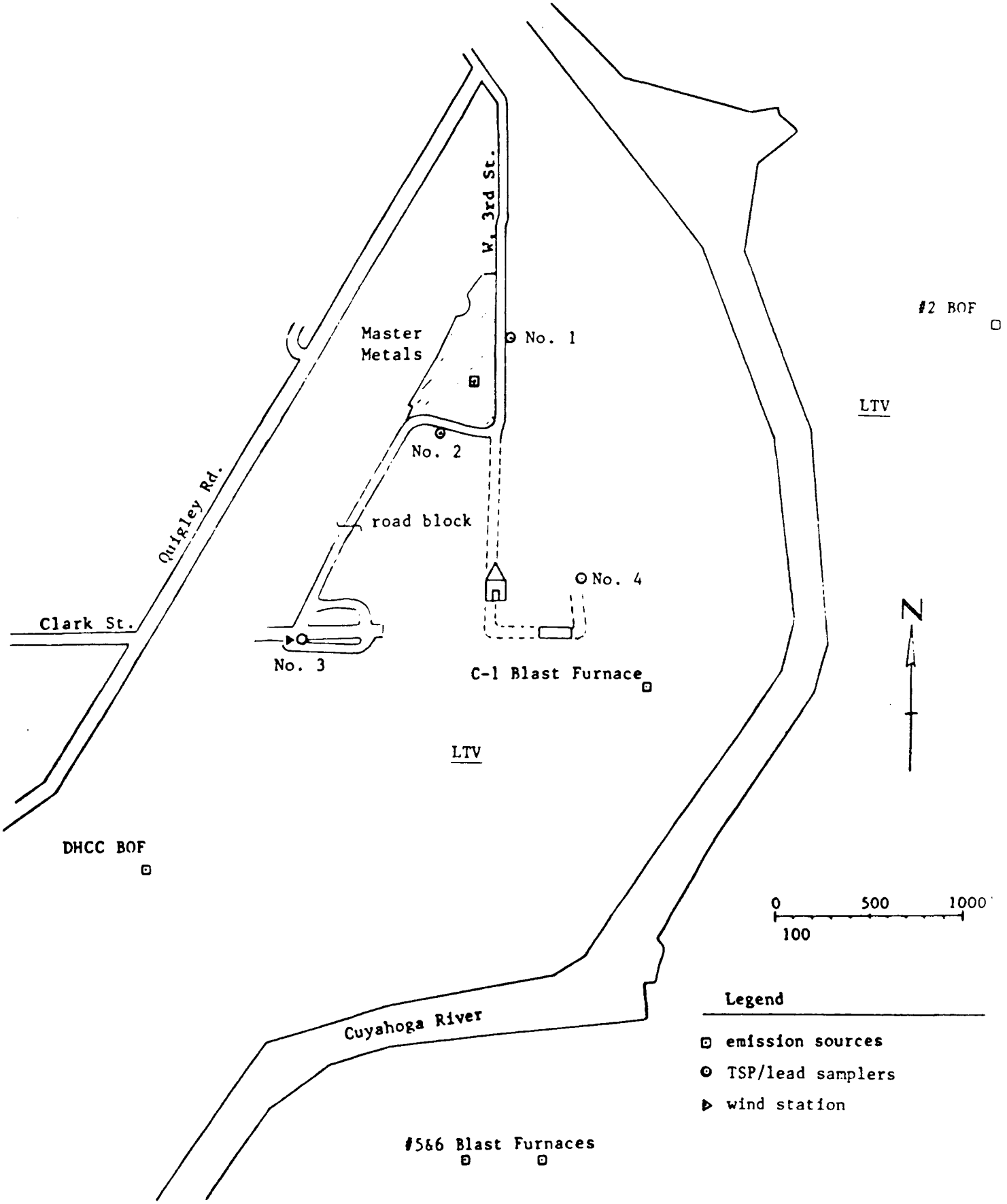



Figure A. Map of Air Monitoring Network

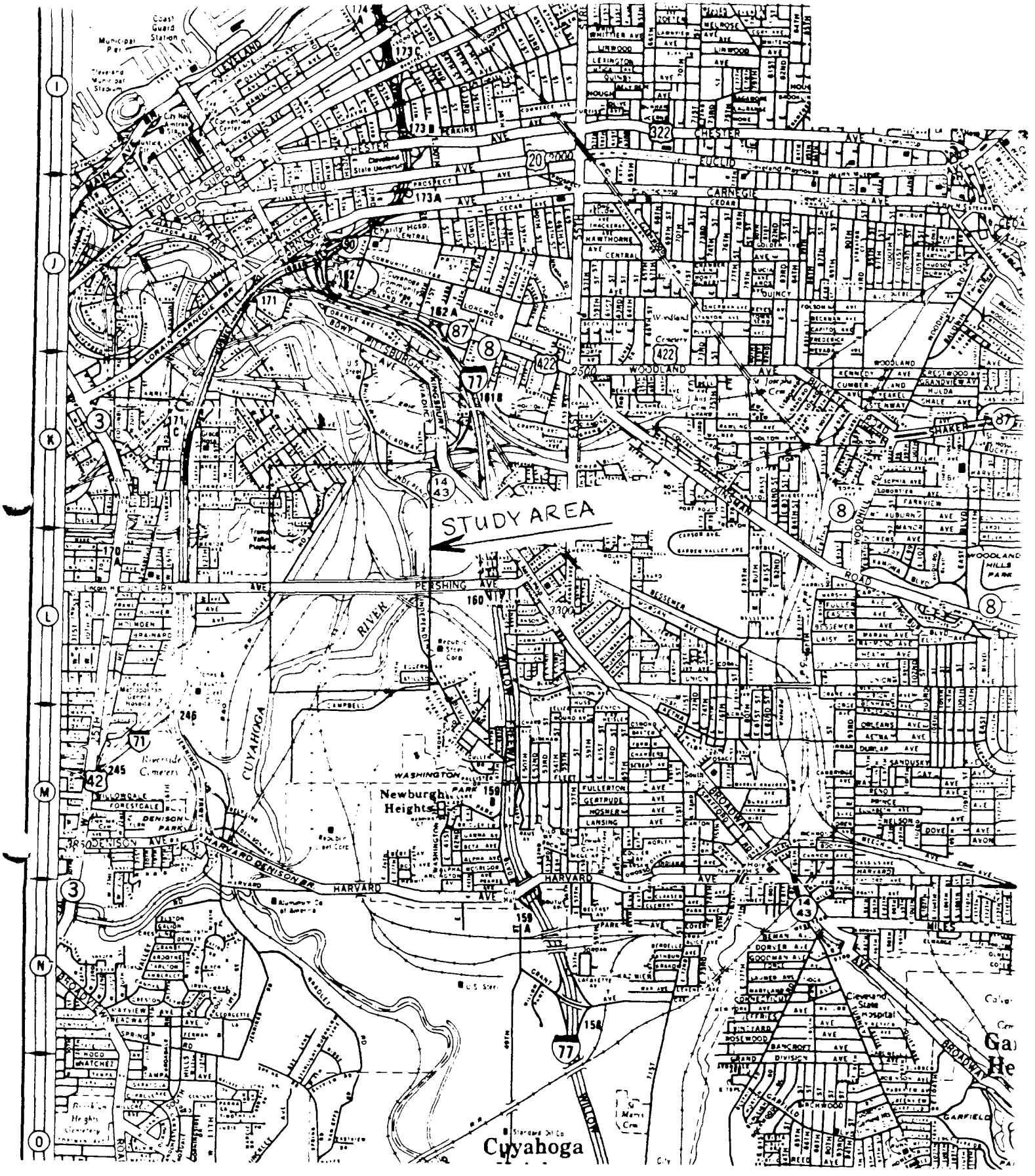



Figure B. Map of Study Area and Surrounding Neighborhoods

quality assurance purposes. The lead results are summarized in Table Nos. 1-4. The daily results are graphed in Appendix A. TSP results are summarized in Table Nos. 5-8. The quarterly averages for lead sampling are summarized in Table No. 9 and are graphed in Figure C. The National Ambient Air Quality Standard for lead was exceeded during each of the first three quarters of 1993 at Site No. 1 and during the first two quarters of 1993 at Site No. 2. There is not an ambient air standard for TSP.

B. Wind Data

Wind roses for were generated for each sampling day. The wind roses are in Appendix B. A composite wind rose, which includes data for all of 1993 is also in Appendix B.

## IV. CONCLUSIONS

The following conclusions were made based on air sampling and wind data.

- Master Metals was the cause of high levels of lead in the air around the secondary lead smelter.
- Lead dust deposited on West Third Street was re-entrained by passing vehicles, which exacerbated the ambient lead levels.
- The lead concentration gradient was very steep over a distance of about 500 meters from Master Metals' emission sources.
- When lead emissions from Master Metals were reduced, the lead concentrations at all of the monitoring stations in the network decreased dramatically.

The conclusions made from the study are explained in the following paragraphs.

A. Source of Lead Emissions

Monitoring stations were located upwind and downwind of Master Metals to determine if the smelter was causing the high levels of ambient lead. Results showed that the smelter was the source of the lead emission. To demonstrate this, the effect of wind direction on measured ambient lead concentrations are presented in Table No. 10. The table includes lead sampling results and wind data for eight sampling days during the year. The first two dates in Table No. 10 give results when winds were persistently from the northeast quadrant. When winds were from the northeast, Site No. 1 was upwind of Master Metals, and Site Nos. 2 and 3 were downwind. On these days, Site No. 1 had low lead levels, and Site Nos. 2 and 3 had their highest lead levels of the study. Site No. 2 had very high concentrations these days. The concentrations at Site No. 3 were elevated, but they were much lower than Site No. 2. This demonstrated that there was a steep concentration gradient of ambient lead with respect to distance from Master Metals. This is detailed in Paragraph IV.C. The second pair of dates in Table No. 10 gives results when winds were persistently from the southeast quadrant. When winds were from the southeast, Site No. 4 was upwind of Master Metals. No sites were downwind. On these days, all of the sites had

## – TABLE 1 –

## Lead Results for Master Metals/LTV Steel Monitoring Study During the First Quarter of 1993

Lead Concentration [ug/m$^3$]

| Date | Site 1<br>39-035-0062 | Site 2<br>39-035-0061 | Site 3<br>39-035-0059 | Site 4<br>39-035-0058 |
|---|---|---|---|---|
| 09-Jan-93 | (see note) | (see note) | 1.4 | (see note) |
| 12-Jan-93 | 0.47 | 17. | 2.3 | 0.2 |
| 15-Jan-93 | 13. | 0.05 | <0.05 | <0.05 |
| 18-Jan-93 | 3.3 | 0.94 | no sample | 0.97 |
| 21-Jan-93 | 2.1 | 0.1 | 0.3 | 0.1 |
| 24-Jan-93 | 3.0 | 0.06 | no sample | <0.05 |
| 27-Jan-93 | 11. | 1.7 | 0.06 | 0.96 |
| 30-Jan-93 | 50. | 0.1 | 0.07 | 0.3 |
| 02-Feb-93 | 8.4 | 6.6 | 0.56 | 0.1 |
| 05-Feb-93 | 21. | 1.0 | 0.1 | 0.65 |
| 08-Feb-93 | 1.9 | 12. | 0.2 | 0.3 |
| 11-Feb-93 | 0.93 | 19. | 1.4 | 0.05 |
| 14-Feb-93 | 7.7 | 0.07 | <0.05 | 0.40 |
| 17-Feb-93 | 12. | 0.09 | no sample | 0.3 |
| 20-Feb-93 | 12. | 0.48 | no sample | 0.85 |
| 23-Feb-93 | 0.80 | 0.08 | <0.05 | 0.81 |
| 26-Feb-93 | 0.3 | 3.5 | 0.2 | <0.05 |
| 01-Mar-93 | 38. | 0.2 | 0.2 | 0.1 |
| 04-Mar-93 | 0.4 | no sample | no sample | 0.08 |
| 07-Mar-93 | 22. | no sample | 0.2 | 0.05 |
| 10-Mar-93 | 0.77 | no sample | 0.4 | 0.2 |
| 13-Mar-93 | 0.67 | 7.5 | 0.58 | 0.1 |
| 16-Mar-93 | no sample | no sample | 0.2 | 0.05 |
| 19-Mar-93 | 1.3 | 0.87 | 0.2 | 0.1 |
| 22-Mar-93 | 1.4 | 0.86 | 0.2 | 0.09 |
| 25-Mar-93 | 3.6 | 0.50 | 0.07 | 0.4 |
| 28-Mar-93 | 0.2 | 0.45 | <0.05 | 0.68 |
| 31-Mar-93 | 2.2 | 2.9 | 0.3 | 0.3 |
| Averages | 8.4 | 3.3 | 0.4 | 0.3 |

Note: Sampling initiated at Sites 1,2, and 4 on January 12. "No sample" means that the sample was lost due to motor maintenance or power failure.

## – TABLE 2 –

## Lead Results for Master Metals/LTV Steel Monitoring Study During the Second Quarter of 1993

Lead Concentration [ug/m$^3$]

| Date | Site 1<br>39-035-0062 | Site 2<br>39-035-0061 | Site 3<br>39-035-0059 | Site 4<br>39-035-0058 |
|---|---|---|---|---|
| 03-Apr-93 | 1.1 | 0.84 | <0.05 | 0.77 |
| 06-Apr-93 | 2.2 | 1.5 | 0.3 | 0.3 |
| 09-Apr-93 | 9.1 | no sample | 0.1 | 0.08 |
| 12-Apr-93 | 2.0 | 5.4 | 0.08 | 0.63 |
| 15-Apr-93 | 12. | 1.6 | 0.3 | 0.3 |
| 18-Apr-93 | 30. | 0.2 | 0.1 | 0.07 |
| 21-Apr-93 | 2.3 | 1.3 | <0.05 | 1.2 |
| 24-Apr-93 | 1.9 | 0.3 | 0.3 | 0.2 |
| 27-Apr-93 | 4.2 | 1.6 | 0.3 | 0.3 |
| 30-Apr-93 | 14. | 0.3 | no sample | 0.61 |
| 03-May-93 | no sample | 1.2 | 0.2 | 0.2 |
| 06-May-93 | 5.7 | 0.68 | <0.05 | 1.0 |
| 09-May-93 | 1.9 | 0.88 | 0.1 | 0.75 |
| 12-May-93 | 11. | 14. | 0.2 | 0.60 |
| 15-May-93 | 16. | 8.5 | 0.09 | 0.57 |
| 18-May-93 | 2.0 | 1.3 | 0.2 | 0.4 |
| 21-May-93 | 5.2 | 1.2 | 0.1 | 0.69 |
| 24-May-93 | 13. | 0.3 | 0.08 | <0.06 |
| 27-May-93 | 1.3 | 1.8 | 0.1 | 0.1 |
| 30-May-93 | 3.5 | 0.4 | 0.06 | 0.06 |
| 02-Jun-93 | 14. | 0.73 | 0.08 | 0.4 |
| 05-Jun-93 | 1.9 | 0.3 | no sample | 0.2 |
| 08-Jun-93 | 6.2 | 0.4 | 0.2 | 0.54 |
| 11-Jun-93 | 1.8 | 3.2 | 0.06 | 0.2 |
| 14-Jun-93 | 6.2 | 0.3 | 0.07 | 0.1 |
| 17-Jun-93 | 8.5 | 0.55 | 0.1 | 0.1 |
| 20-Jun-93 | 16. | 0.1 | <0.06 | <0.05 |
| 23-Jun-93 | 1.1 | 2.3 | 0.09 | 0.2 |
| 26-Jun-93 | 12. | 0.4 | <0.06 | <0.05 |
| 29-Jun-93 | 1.2 | 6.7 | 0.72 | 0.09 |
| Averages | 7.1 | 2.0 | 0.14 | 0.36 |

Note: "No sample" means that the sample was lost due to motor maintenance or power failure.

## – TABLE 3 –

## Lead Results for Master Metals/LTV Steel Monitoring Study During the Third Quarter of 1993

Lead Concentration [ug/m$^3$]

| Date | Site 1<br>39–035–0062 | Site 2<br>39–035–0061 | Site 3<br>39–035–0059 | Site 4<br>39–035–0058 |
|---|---|---|---|---|
| 02–Jul–93 | 3.5 | 0.90 | 0.2 | 1.0 |
| 05–Jul–93 | 0.95 | no sample | no sample | <0.05 |
| 08–Jul–93 | 4.0 | no sample | 0.1 | 0.2 |
| 11–Jul–93 | 13. | no sample | 0.08 | <0.05 |
| 14–Jul–93 | 6.1 | 0.77 | 0.07 | 0.3 |
| 17–Jul–93 | 1.5 | 11. | 0.3 | 0.1 |
| 20–Jul–93 | 7.7 | 0.3 | <0.06 | no sample |
| 23–Jul–93 | 4.7 | 2.0 | 0.2 | no sample |
| 26–Jul–93 | 5.6 | no sample | 0.1 | 0.4 |
| 29–Jul–93 | 6.7 | 3.2 | <0.06 | 0.3 |
| 01–Aug–93 | 3.9 | 0.2 | 0.08 | 0.1 |
| 04–Aug–93 | 3.9 | 2.6 | <0.06 | no sample |
| 07–Aug–93 | 0.96 | 0.3 | <0.06 | no sample |
| 10–Aug–93 | 9.3 | 0.2 | 0.09 | 0.2 |
| 13–Aug–93 | 0.99 | 0.47 | 0.2 | 0.2 |
| 16–Aug–93 | 4.4 | 0.87 | 0.07 | 0.2 |
| 19–Aug–93 | 0.98 | 0.4 | 0.1 | 0.1 |
| 22–Aug–93 | 0.3 | 0.3 | 0.1 | 0.1 |
| 25–Aug–93 | 0.53 | 0.2 | 0.1 | 0.1 |
| 28–Aug–93 | 0.3 | 0.2 | <0.05 | 0.08 |
| 31–Aug–93 | 2.9 | 0.47 | 0.07 | 0.2 |
| 03–Sep–93 | 0.73 | 0.2 | 0.09 | 0.08 |
| 06–Sep–93 | 0.3 | 0.1 | 0.09 | <0.05 |
| 09–Sep–93 | 6.0 | 0.06 | 0.1 | 0.05 |
| 12–Sep–93 | 1.9 | 0.1 | 0.1 | <0.05 |
| 15–Sep–93 | 2.3 | 0.3 | 0.05 | 0.07 |
| 18–Sep–93 | 0.2 | 0.07 | <0.06 | <0.05 |
| 21–Sep–93 | no sample | 0.52 | 0.08 | 0.2 |
| 24–Sep–93 | no sample | 0.3 | 0.2 | 0.4 |
| 27–Sep–93 | 0.48 | 0.08 | 0.1 | 0.1 |
| 30–Sep–93 | 0.2 | 0.1 | 0.1 | 0.1 |
| Averages | 3.3 | 1.0 | 0.09 | 0.17 |

Note: "No sample" means that the sample was lost due to motor maintenance or power failure.

## – TABLE 4 –

## Lead Results for Master Metals/LTV Steel Monitoring Study During the Fourth Quarter of 1993

Lead Concentration [ug/m$^3$]

| Date | Site 1<br>39–035–0062 | Site 2<br>39–035–0061 | Site 3<br>39–035–0059 | Site 4<br>39–035–0058 |
|---|---|---|---|---|
| 03–Oct–93 | 2.5 | 0.2 | 0.2 | no sample |
| 06–Oct–93 | 0.3 | 0.07 | 0.2 | 0.06 |
| 09–Oct–93 | 0.63 | 0.4 | <0.05 | <0.05 |
| 12–Oct–93 | 9.2 | 0.2 | 0.06 | 0.08 |
| 15–Oct–93 | 0.4 | 0.05 | 0.1 | 0.06 |
| 18–Oct–93 | 0.3 | 0.2 | <0.05 | 0.05 |
| 21–Oct–93 | 2.8 | 0.06 | <0.05 | 0.07 |
| 24–Oct–93 | 1.3 | <0.05 | 0.07 | <0.05 |
| 27–Oct–93 | 0.41 | <0.05 | <0.05 | <0.05 |
| 30–Oct–93 | <0.05 | 0.2 | <0.05 | <0.05 |
| 02–Nov–93 | 0.2 | 0.06 | 0.1 | 0.06 |
| 05–Nov–93 | 2.2 | 0.05 | 0.1 | 0.06 |
| 08–Nov–93 | 0.78 | 0.05 | 0.2 | 0.07 |
| 11–Nov–93 | 5.1 | 0.1 | 0.2 | no sample |
| 14–Nov–93 | 0.46 | no sample | 0.09 | no sample |
| 17–Nov–93 | 0.2 | 0.1 | <0.05 | no sample |
| 20–Nov–93 | 1.2 | 0.08 | <0.05 | <0.05 |
| 23–Nov–93 | 0.3 | 0.07 | 0.1 | 0.07 |
| 26–Nov–93 | 0.1 | <0.05 | 0.07 | no sample |
| 29–Nov–93 | 0.4 | 0.05 | 0.06 | <0.05 |
| 02–Dec–93 | 0.46 | 0.05 | 0.09 | no sample |
| 05–Dec–93 | 0.08 | 0.05 | <0.05 | 0.07 |
| 08–Dec–93 | 0.73 | 0.05 | 0.07 | no sample |
| 11–Dec–93 | 0.2 | 0.54 | <0.05 | 0.2 |
| 14–Dec–93 | 1.4 | 0.58 | 0.1 | 0.1 |
| 17–Dec–93 | 0.88 | 0.05 | <0.05 | no sample |
| 20–Dec–93 | no sample | no sample | 0.06 | no sample |
| 23–Dec–93 | 0.07 | 0.1 | <0.05 | <0.05 |
| 26–Dec–93 | 0.46 | 0.06 | <0.05 | no sample |
| 29–Dec–93 | 0.40 | 0.07 | 0.06 | no sample |
| Averages | 1.2 | 0.12 | 0.06 | 0.05 |

Note: "No sample" means that the sample was lost due to motor maintenance or power failure.

## – TABLE 5 –

## Total Suspended Particulate Results for Master Metals/LTV Steel Monitoring Study During the First Quarter of 1993

TSP Concentration [ug/m$^3$]

| Date | Site 1<br>39-035-0062 | Site 2<br>39-035-0061 | Site 3<br>39-035-0059 | Site 4<br>39-035-0058 |
|---|---|---|---|---|
| 09-Jan-93 | (see note) | (see note) | 45.0 | (see note) |
| 12-Jan-93 | 59.1 | 87.6 | 47.2 | 57.4 |
| 15-Jan-93 | 162. | 42.4 | 53.0 | 54.4 |
| 18-Jan-93 | 144. | 60.0 | no sample | 42.4 |
| 21-Jan-93 | 188. | 72.6 | 244. | 443. |
| 24-Jan-93 | 38.2 | 29.5 | no sample | 17.5 |
| 27-Jan-93 | 136. | 77.4 | 80.2 | 67.6 |
| 30-Jan-93 | 227. | 61.6 | 121. | 136. |
| 02-Feb-93 | 293. | 93.1 | 93.5 | 75.6 |
| 05-Feb-93 | 244. | 76.4 | 110. | 171. |
| 08-Feb-93 | 117. | 99.1 | 55.0 | 41.0 |
| 11-Feb-93 | 62.8 | 118. | 55.3 | 57.4 |
| 14-Feb-93 | 42.5 | 18.6 | 20.0 | 21.5 |
| 17-Feb-93 | 77.9 | 24.9 | no sample | 31.0 |
| 20-Feb-93 | 138. | 84.7 | no sample | 80.9 |
| 23-Feb-93 | 34.1 | 17.8 | 22.2 | 20.3 |
| 26-Feb-93 | 62.3 | 59.3 | 39.0 | 40.8 |
| 01-Mar-93 | 310. | 96.9 | 187. | 97.4 |
| 04-Mar-93 | 60.3 | no sample | no sample | 88.3 |
| 07-Mar-93 | 186. | no sample | 128. | 108. |
| 10-Mar-93 | 83.7 | no sample | 45.1 | 67.3 |
| 13-Mar-93 | 69.6 | 63.3 | 45.0 | 32.7 |
| 16-Mar-93 | no sample | no sample | 133. | 111. |
| 19-Mar-93 | 160. | 121. | 227. | 292. |
| 22-Mar-93 | 144. | 104. | 203. | 122. |
| 25-Mar-93 | 190. | 103. | 89.1 | 98.9 |
| 28-Mar-93 | 49.5 | 45.7 | 47.0 | 45.9 |
| 31-Mar-93 | 225. | 244. | 347. | 336. |
| Averages | 135. | 78.3 | 106. | 102. |

Note: Sampling initiated at Sites 1,2, and 4 on January 12. "No sample" means that the sample was lost due to motor maintenance or power failure.

## – TABLE 6 –

## Total Suspended Particulate Results for Master Metals/LTV Steel Monitoring Study During the Second Quarter of 1993

TSP Concentration [ug/m$^3$]

| Date | Site 1 39-035-0062 | Site 2 39-035-0061 | Site 3 39-035-0059 | Site 4 39-035-0058 |
|---|---|---|---|---|
| 03-Apr-93 | 70.5 | 37.5 | 41.1 | 36.0 |
| 06-Apr-93 | 179. | 227. | 255. | 36.6 |
| 09-Apr-93 | 215. | no sample | 218. | 299. |
| 12-Apr-93 | 117. | 73.3 | 64.3 | 48.9 |
| 15-Apr-93 | 176. | 318. | 372. | 376. |
| 18-Apr-93 | 170. | 73.8 | 146. | 59.0 |
| 21-Apr-93 | 92.3 | 38.8 | 27.7 | 39.5 |
| 24-Apr-93 | 79.0 | 76.5 | 144. | 101. |
| 27-Apr-93 | 169. | 105. | 184. | 104. |
| 30-Apr-93 | 134. | 84.8 | no sample | 82.9 |
| 03-May-93 | no sample | 256. | 241. | 267. |
| 06-May-93 | 142. | 65.7 | 76.4 | 57.9 |
| 09-May-93 | 136. | 120. | 178. | 118. |
| 12-May-93 | 284. | 288. | 305. | 239. |
| 15-May-93 | 194. | 192. | 194. | 151. |
| 18-May-93 | 164. | 219. | 178. | 215. |
| 21-May-93 | 165. | 161. | 218. | 118. |
| 24-May-93 | 131. | 97.7 | 114. | 102. |
| 27-May-93 | 141. | 176. | 144. | 119. |
| 30-May-93 | 92.1 | 132. | 124. | 84.2 |
| 02-Jun-93 | 128. | 73.6 | 125. | 64.9 |
| 05-Jun-93 | 35.3 | 27.9 | no sample | 25.8 |
| 08-Jun-93 | 111. | 71.0 | 129. | 67.1 |
| 11-Jun-93 | 117. | 89.2 | 95.3 | 71.7 |
| 14-Jun-93 | 155. | 142. | 154. | 180. |
| 17-Jun-93 | 185. | 207. | 242. | 188. |
| 20-Jun-93 | 103. | 70.1 | 87.6 | 68.9 |
| 23-Jun-93 | 105. | 91.9 | 111. | 87.3 |
| 26-Jun-93 | 82.6 | 44.0 | 71.0 | 41.1 |
| 29-Jun-93 | 73.4 | 62.1 | 63.8 | 47.7 |
| Averages | 136. | 125. | 154. | 117. |

Note: "No sample" means that the sample was lost due to motor maintenance or power failure.

## – TABLE 7 –

## Total Suspended Particulate Results for Master Metals/LTV Steel Monitoring Study During the Third Quarter of 1993

TSP Concentration [ug/m$^3$]

| Date | Site 1 39-035-0062 | Site 2 39-035-0061 | Site 3 39-035-0059 | Site 4 39-035-0058 |
|---|---|---|---|---|
| 02-Jul-93 | 146. | 102. | 136. | 118. |
| 05-Jul-93 | 130. | no sample | no sample | 216. |
| 08-Jul-93 | 118. | no sample | 150. | 86.4 |
| 11-Jul-93 | 97.0 | no sample | 89.5 | 78.1 |
| 14-Jul-93 | 142. | 84.6 | 159. | 144. |
| 17-Jul-93 | 104. | 128. | 118. | 92.6 |
| 20-Jul-93 | 91.9 | 55.7 | 64.5 | no sample |
| 23-Jul-93 | 167. | 152. | 159. | no sample |
| 26-Jul-93 | 121. | no sample | 112. | 122. |
| 29-Jul-93 | 83.2 | 56.3 | 53.5 | 65.5 |
| 01-Aug-93 | 101. | 81.1 | 149. | 100. |
| 04-Aug-93 | 61.5 | 36.4 | 38.4 | no sample |
| 07-Aug-93 | 60.3 | 50.0 | 63.8 | no sample |
| 10-Aug-93 | 200. | 155 | 233. | 301. |
| 13-Aug-93 | 166. | 144 | 151. | 170. |
| 16-Aug-93 | 108. | 86.5 | 101. | 97.7 |
| 19-Aug-93 | 141. | 113. | 206. | 192. |
| 22-Aug-93 | 79.9 | 77.4 | 101. | 84.4 |
| 25-Aug-93 | 145. | 120. | 126. | 134. |
| 28-Aug-93 | 46.8 | 41.5 | 52.1 | 59.3 |
| 31-Aug-93 | 124. | 117. | 160. | 108. |
| 03-Sep-93 | 67.1 | 50.6 | 81.1 | 81.7 |
| 06-Sep-93 | 58.0 | 46.8 | 73.7 | 46.3 |
| 09-Sep-93 | 156. | 114. | 212. | 167. |
| 12-Sep-93 | 122. | 95.4 | 179. | 231. |
| 15-Sep-93 | 68.6 | 55.8 | 87.3 | 37.9 |
| 18-Sep-93 | 57.5 | 56.5 | 77.2 | 65.9 |
| 21-Sep-93 | no sample | 77.5 | 127. | 132. |
| 24-Sep-93 | no sample | 84.1 | 170. | 108. |
| 27-Sep-93 | 72.0 | 46.5 | 109. | 107. |
| 30-Sep-93 | 66.6 | 45.5 | 85.7 | 72.2 |
| Averages | 107. | 84.2 | 121. | 119. |

Note: "No sample" means that the sample was lost due to motor maintenance or power failure.

## – TABLE 8 –

## Total Suspended Particulate Results for Master Metals/LTV Steel Monitoring Study During the Fourth Quarter of 1993

TSP Concentration [ug/m$^3$]

| Date | Site 1<br>39-035-0062 | Site 2<br>39-035-0061 | Site 3<br>39-035-0059 | Site 4<br>39-035-0058 |
|---|---|---|---|---|
| 03-Oct-93 | 71.5 | 67.2 | 126. | no sample |
| 06-Oct-93 | 255. | 186. | 269. | 377. |
| 09-Oct-93 | 43.8 | 47.8 | 79.0 | 33.7 |
| 12-Oct-93 | 100. | 66.2 | 118. | 103. |
| 15-Oct-93 | 217. | 166. | 444. | 385. |
| 18-Oct-93 | 49.7 | 32.9 | 44.9 | 38.8 |
| 21-Oct-93 | 49.5 | 50.3 | 65.3 | 72.8 |
| 24-Oct-93 | 74.2 | 63.7 | 117. | 81.7 |
| 27-Oct-93 | 48.2 | 40.0 | 52.6 | 43.2 |
| 30-Oct-93 | 18.2 | 17.5 | 28.5 | 37.1 |
| 02-Nov-93 | 149. | 130. | 161. | 392. |
| 05-Nov-93 | 88.1 | 70.7 | 116. | 97.7 |
| 08-Nov-93 | 164. | 124. | 211. | 230. |
| 11-Nov-93 | 195. | 184. | 350. | no sample |
| 14-Nov-93 | 52.4 | no sample | 100. | no sample |
| 17-Nov-93 | 41.4 | 32.4 | 57.1 | no sample |
| 20-Nov-93 | 42.2 | 31.9 | 38.1 | 53.4 |
| 23-Nov-93 | 238. | 209. | 374. | 265. |
| 26-Nov-93 | 111. | 80.0 | 129. | no sample |
| 29-Nov-93 | 61.5 | 44.2 | 62.9 | 48.0 |
| 02-Dec-93 | 134. | 76.2 | 217. | no sample |
| 05-Dec-93 | 36.5 | 22.3 | 31.9 | 29.3 |
| 08-Dec-93 | 131. | 69.0 | 167. | no sample |
| 11-Dec-93 | 44.2 | 40.3 | 47.3 | 56.6 |
| 14-Dec-93 | 209. | 170. | 191. | 162. |
| 17-Dec-93 | 81.6 | 55.3 | 85.4 | no sample |
| 20-Dec-93 | no sample | no sample | 83.0 | no sample |
| 23-Dec-93 | 24.8 | 21.4 | 29.8 | 29.9 |
| 26-Dec-93 | 29.2 | 22.9 | 26.0 | no sample |
| 29-Dec-93 | 78.0 | 55.6 | 92.1 | no sample |
| Averages | 94.6 | 77.7 | 130. | 134. |

Note: "No sample" means that the sample was lost due to motor maintenance or power failure.

– TABLE 9 –

## Quarterly Lead Results for Master Metals/LTV Steel Monitoring Study

| Dates (1993) | Average Lead Concentration [ug/m$^3$] | | | |
|---|---|---|---|---|
| | Site 1 39-035-0062 | Site 2 39-035-0061 | Site 3 39-035-0059 | Site 4 39-035-0058 |
| Jan 1 – Mar 31 | 8.4 | 3.3 | 0.4 | 0.3 |
| Apr 1 – Jun 30 | 7.1 | 2.0 | 0.14 | 0.36 |
| Jul 1 – Sep 30 | 3.3 | 1.0 | 0.09 | 0.17 |
| Oct 1 – Dec 31 | 1.2 | 0.12 | 0.06 | 0.05 |

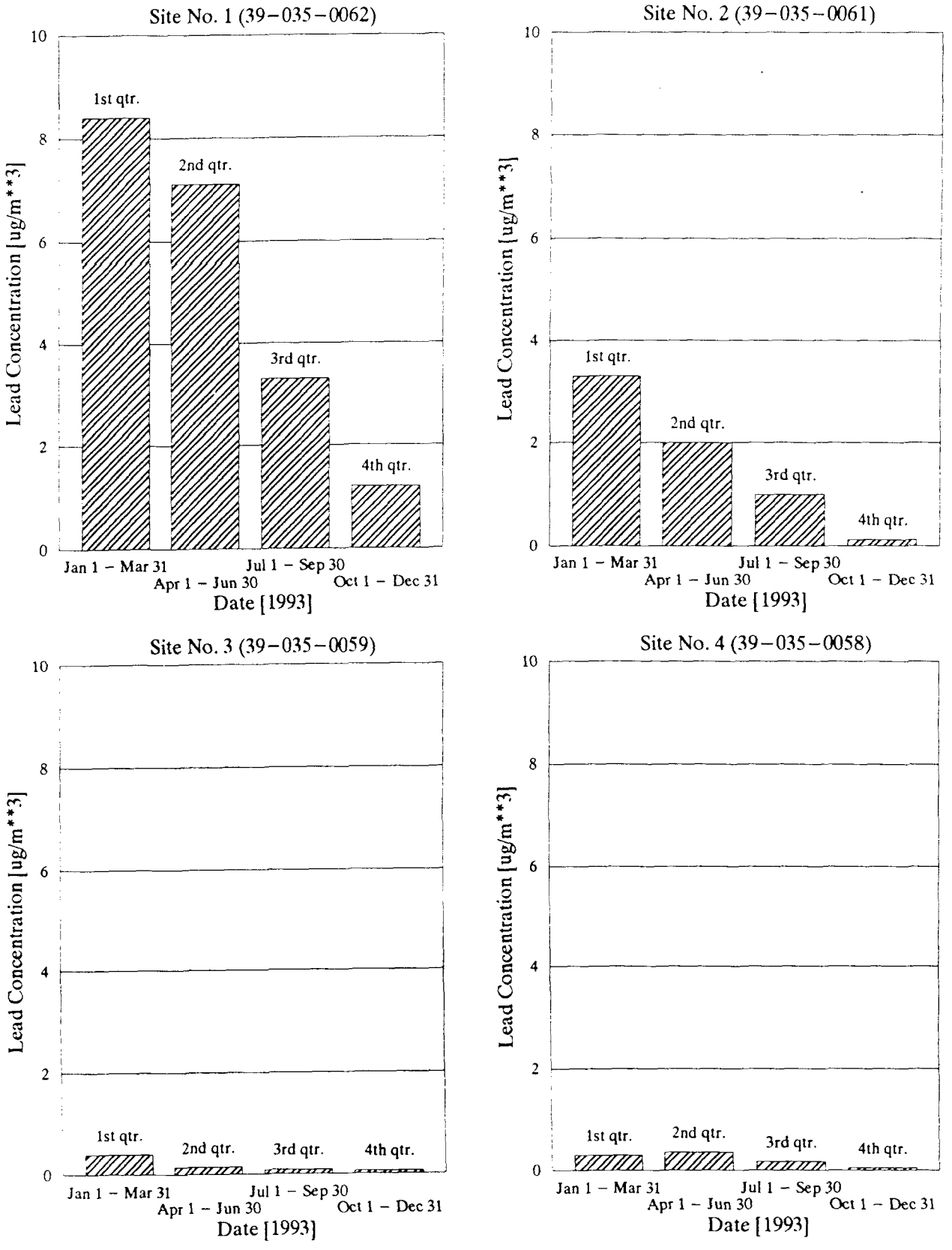



Figure C. Graph of Quarterly Lead Results for Master Metals/LTV Steel Monitoring Study

## – TABLE 10 –

## Effect of Wind Direction on Measured Lead Concentrations

| Date | Wind Quadrant | Lead Concentration [ug/m$^3$] Site 1 ~75 m NE | Site 2 ~70 m SSW | Site 3 ~490 m SW | Site 4 ~370 m SSE |
|---|---|---|---|---|---|
| Jan. 12 | NE | 0.47 | 17 | 2.3 | 0.2 |
| Feb. 11 | NE | 0.93 | 19 | 1.4 | 0.05 |
| Mar. 22 | SE | 1.4 | 0.86 | 0.2 | 0.09 |
| Mar. 19 | SE | 1.3 | 0.87 | 0.2 | 0.1 |
| Jan. 15 | SW | 13 | 0.05 | <0.05 | <0.05 |
| Jan. 30 | SW | 50 | 0.1 | 0.07 | 0.3 |
| Feb. 23 | NW | 0.80 | 0.08 | <0.05 | 0.81 |
| Mar. 28 | NW | 0.2 | 0.45 | <0.05 | 0.68 |

Notes: 1. The "wind quadrant" indicates the general direction from which the wind was blowing.
2. The distances and directions under each site heading indicate the distance and direction to the monitoring station from Master Metals central emission point.

low lead levels. The third pair of dates in Table No. 10 gives results when winds were persistently from the southwest quadrant. When winds were from the southwest, Site Nos. 2 and 3 were upwind of Master Metals, and Site No. 1 was downwind. On these days, Site Nos. 2 and 3 had low lead levels, and Site No. 1 had its highest concentrations of the study. On the fourth pair of dates, winds were persistently from the northwest quadrant. On these days, no sites were upwind of Master Metals, and Site No. 4 was downwind. Site Nos. 1, 2, and 3 had low lead levels and Site No. 4 had its highest concentrations of the study, though they were low in comparison with the NAAQS. This was due to the steep concentration gradient and the distance of Site No. 4 from Master Metals.

B. Re-entrainment of Lead

The two fence line sites consistently recorded the highest lead concentrations. Of the two fence line sites, Site No. 1 had the higher concentrations. This was due in part to it being the station that was most often downwind of Master Metals (see the overall windrose in the Appendix B). Another contributing factor to high lead levels at Site No. 1 was re-entrainment of lead dust on West Third Street. When dust from Master Metals fell to the ground, it was thrown back into the air by passing cars and trucks. If the concentration at a site was only affected by direct emissions, then Site Nos. 1 and 2 would have comparable results on days when they were downwind. It turned out that Site No. 1 consistently yielded higher concentrations than Site No. 2, when looking at results on days when one of the sites was predominately downwind.

C. Lead Concentration Gradient

Sampling results revealed that there were not high levels of lead at Site Nos. 3 or 4. This showed that ambient lead concentrations decreased with distance from the source (Master Metals). Since Master Metals' emission sources and Site Nos. 2 and 3 fall on a nearly straight line, the data from Site Nos. 2 and 3 were compared on days that the wind direction was along this line. Table No. 11 includes 12 pairs of data for days when winds were from the northeast quadrant for much of the day. On these days, Site Nos. 2 and 3 were downwind of Master Metals. The data demonstrate how sharply the lead levels dropped over a distance of less than 500 meters. Site No. 3 was about 490 meters from Master Metals' central emission point. Site Nos. 2 and 3 were about 420 meters apart.

D. Reductions in Lead Emissions and Ambient Lead

Figure C shows the decrease in lead levels at all of the monitoring stations during the year. As the overall lead emissions from the smelter decreased, all stations benefitted. Smelting operations at Master Metals ceased on or about August 6, 1993, though other activities continued. The quarterly average at Site No. 1 dropped by 86 percent from the first to the fourth quarter, the average at Site No. 2 dropped by 96 percent, Site No. 3 dropped by 85 percent, and Site No. 4 dropped by 83 percent.

## – TABLE 11 –

## Concentration Gradient of Ambient Lead

| Date (1993) | Lead Concentration [ug/m$^3$] Site 2 39-035-0061 | Site 3 39-035-0059 |
|---|---|---|
| Jan. 12 | 17 | 2.3 |
| Feb. 02 | 6.6 | 0.56 |
| Feb. 08 | 12 | 0.2 |
| Feb. 11 | 19 | 1.4 |
| Feb. 26 | 3.5 | 0.2 |
| Mar. 13 | 7.5 | 0.58 |
| Apr. 12 | 5.4 | 0.08 |
| May 12 | 14 | 0.2 |
| May 15 | 8.5 | 0.09 |
| Jun. 11 | 3.2 | 0.06 |
| Jun. 29 | 6.7 | 0.72 |
| Jul. 17 | 11 | 0.3 |

Notes: Site 2 is about 70 meters south-southwest of Master Metals' central emission point and Site 3 is about 490 meters southwest of it.

On the dates listed, the winds were from the northeast quadrant for much of the day.

# - Appendix A -

## Graphs of Daily Lead Results

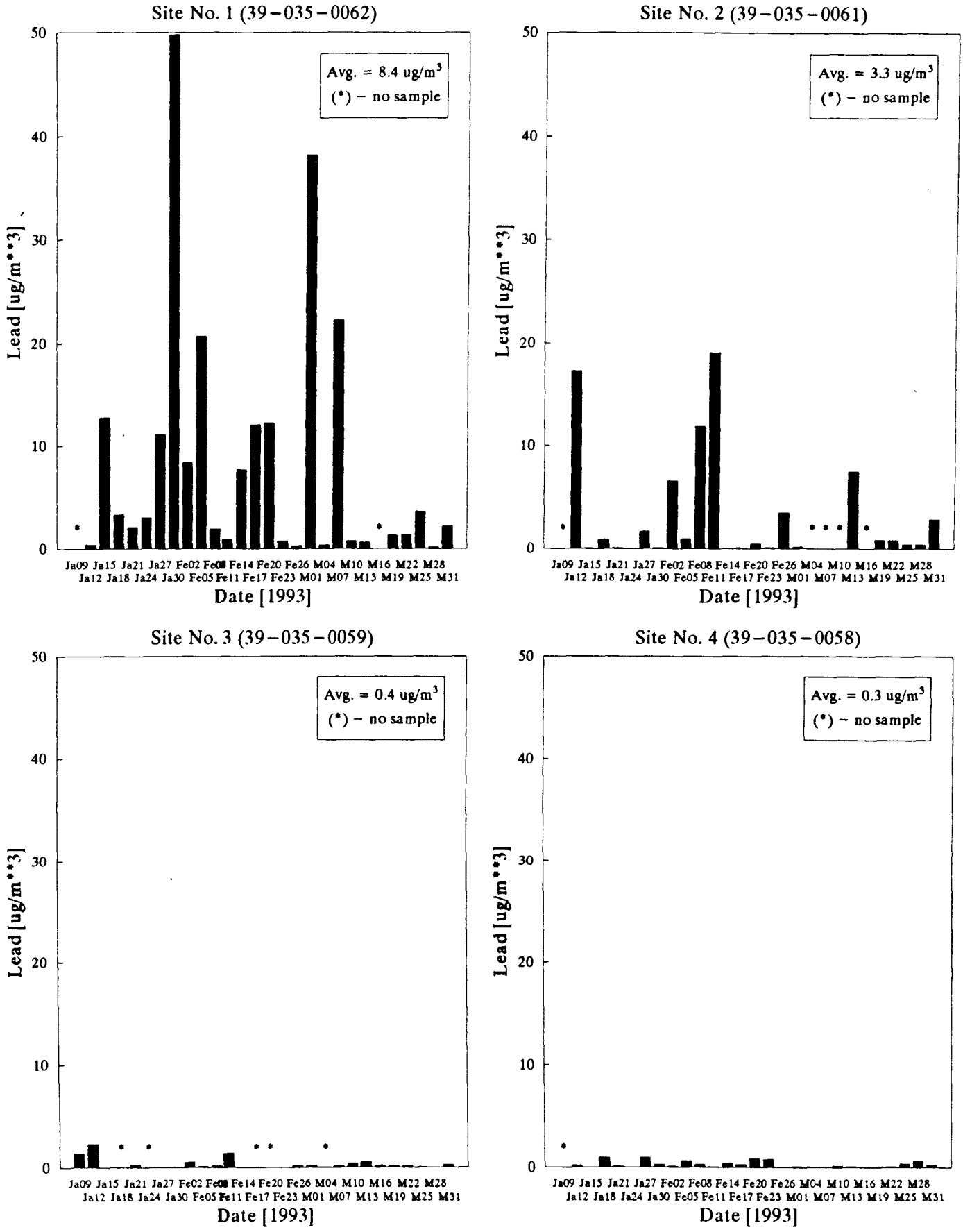



Figure 1. Lead Results for Master Metals/LTV Steel Monitoring Study During the First Quarter of 1993.

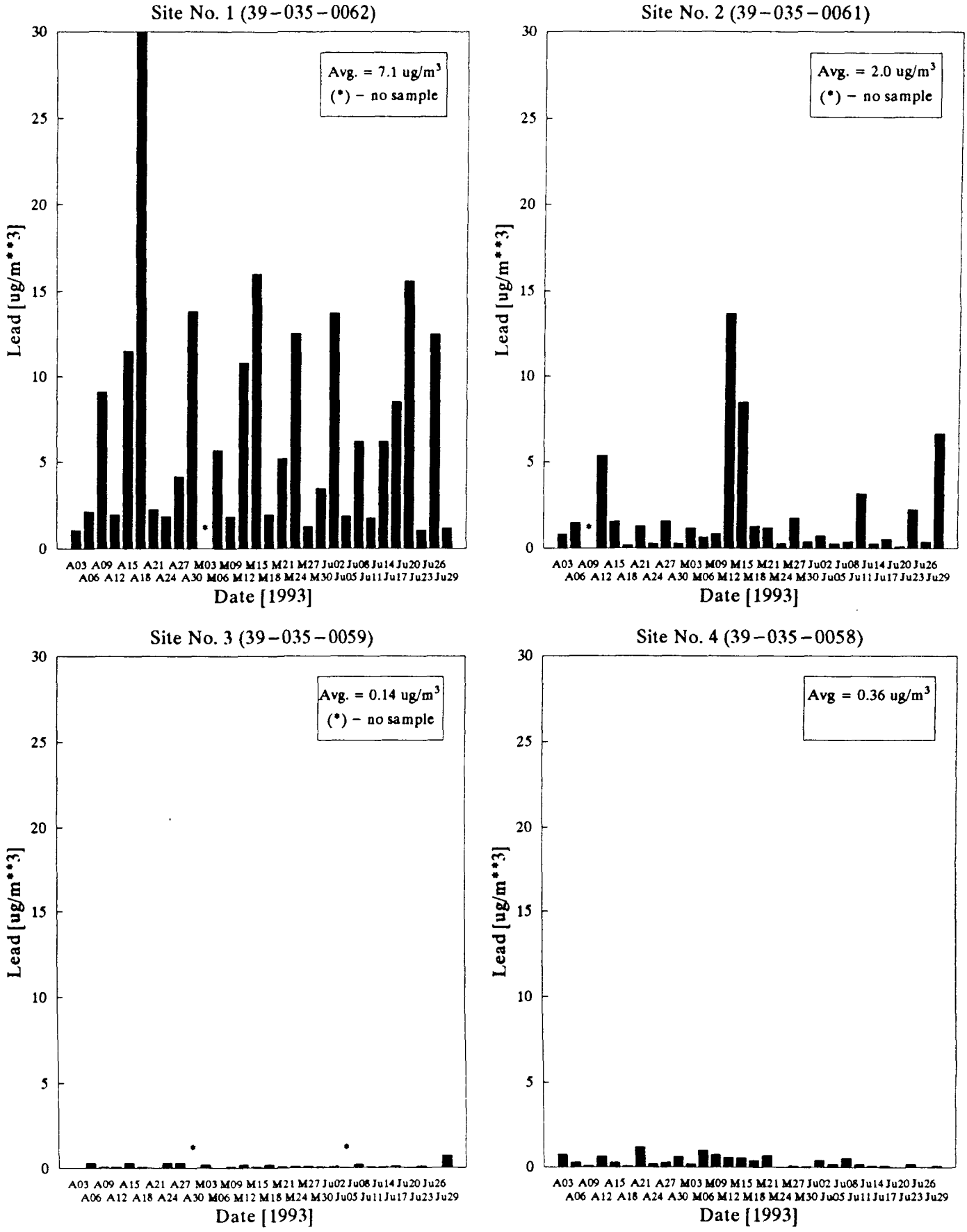



**Figure 2. Lead Results for Master Metals/LTV Steel Monitoring Study During Second Quarter of 1993.**

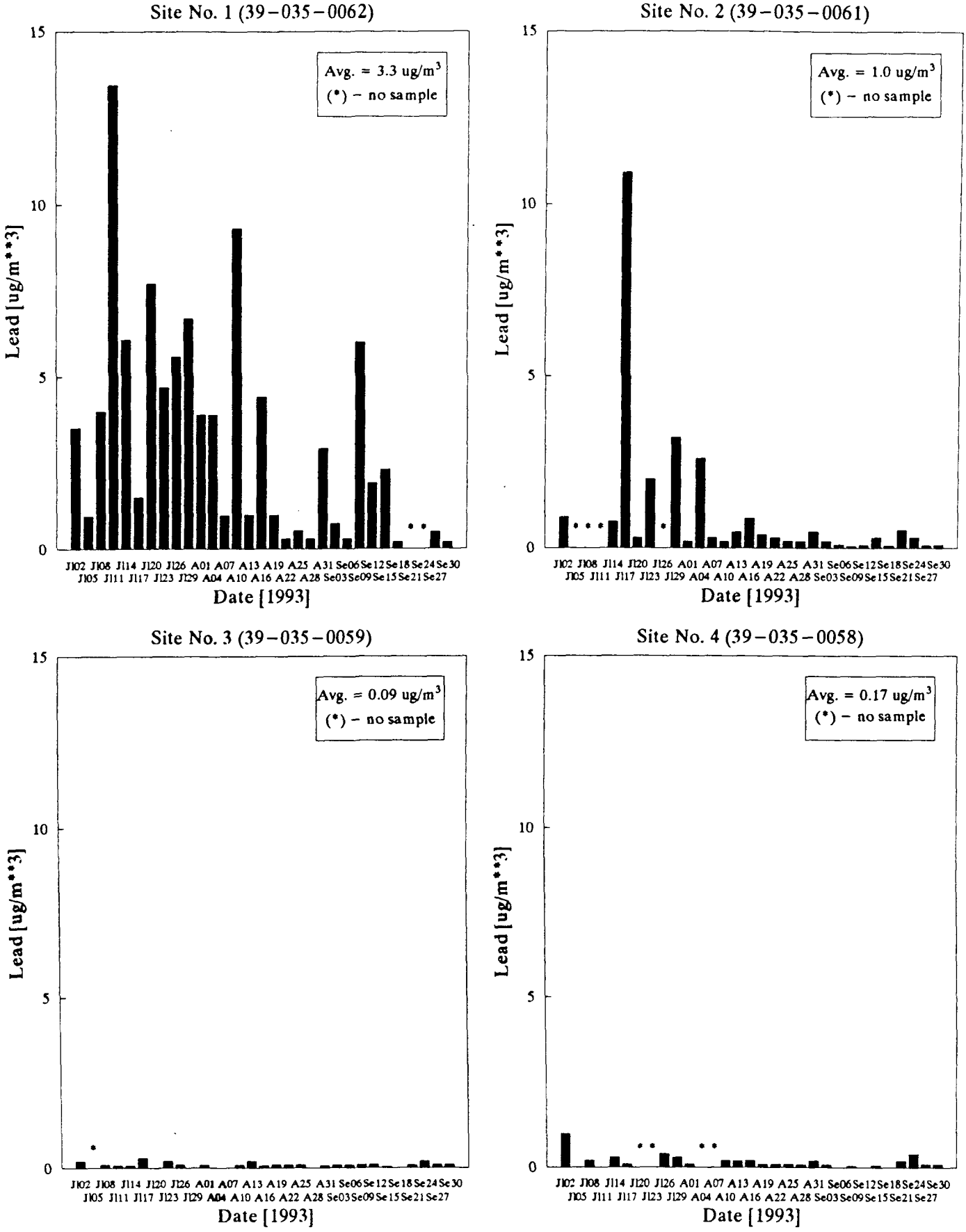



**Figure 3. Lead Results for Master Metals/LTV Steel Monitoring Study During Third Quarter of 1993.**

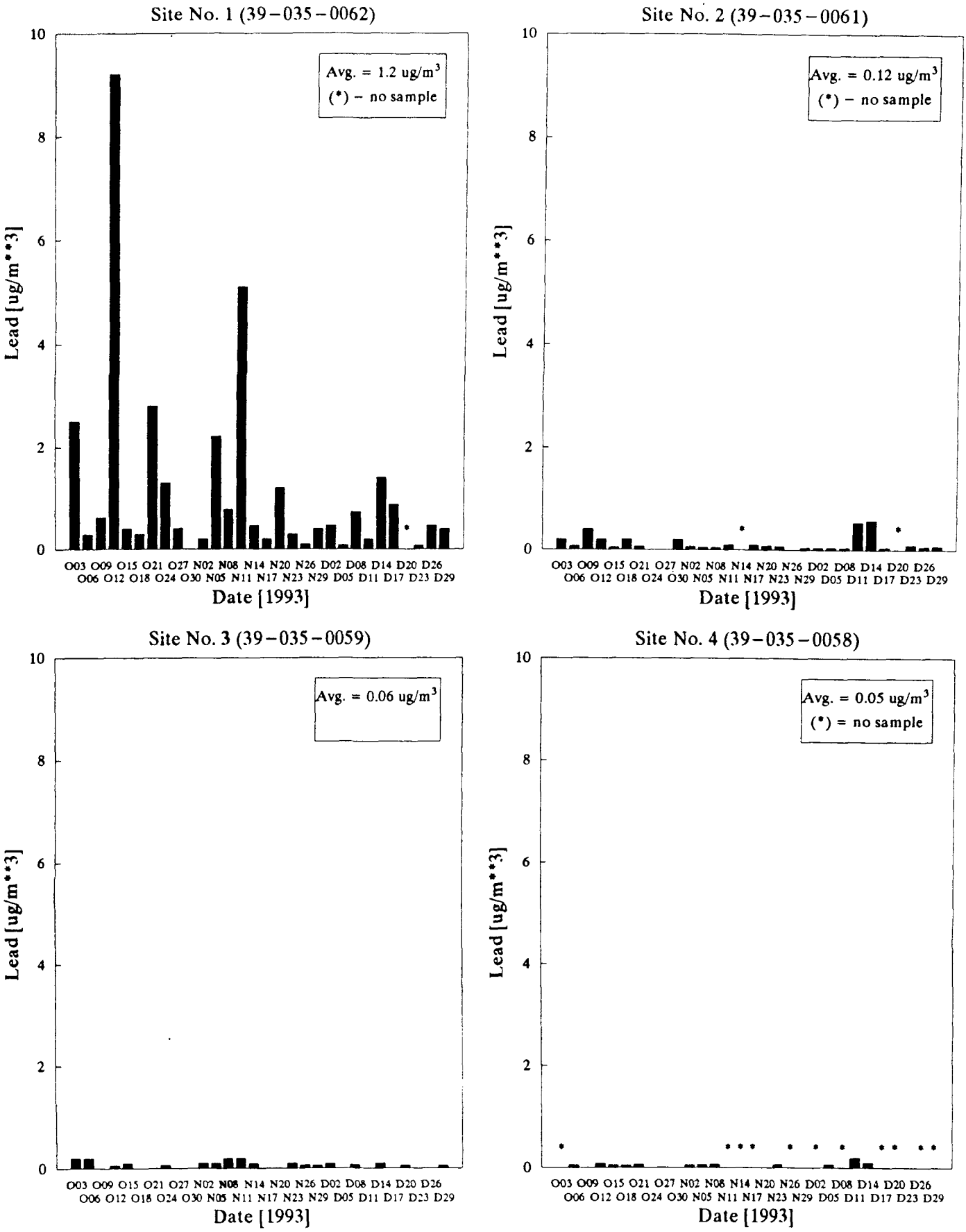


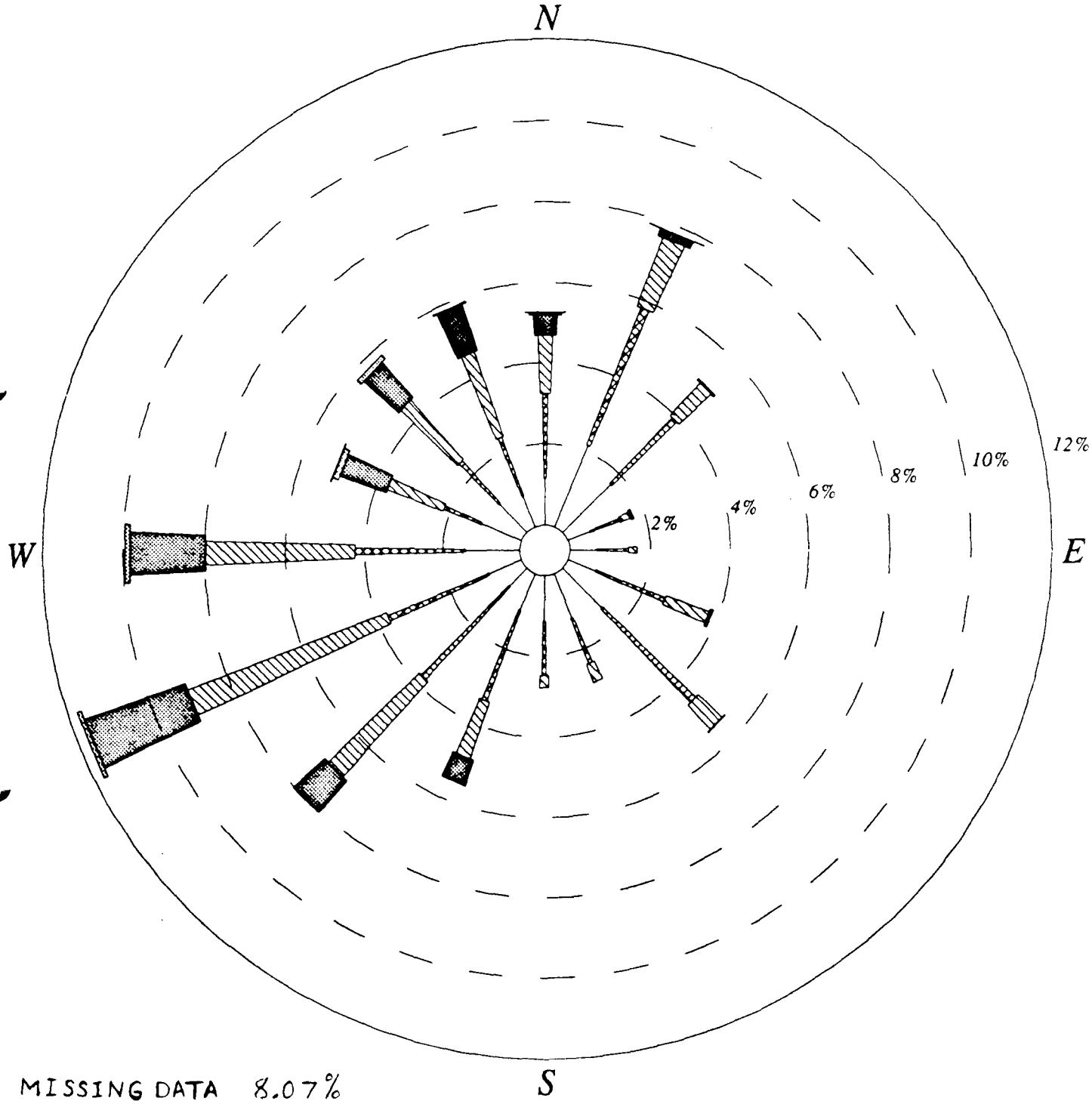

**Figure 4. Lead Results for Master Metals/LTV Monitoring Study During Fourth Quarter of 1993.**

# - Appendix B -

## Wind Roses for Sample Days

# *MASTER METALS - 1993*

## *January 1-December 31; Midnight-11 PM*

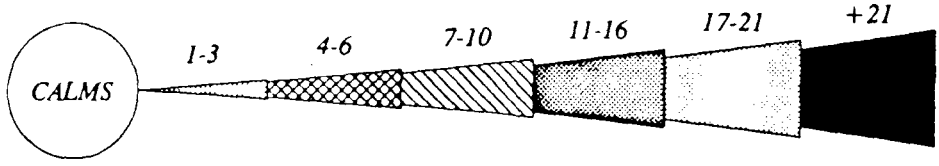



MISSING DATA 8.07%

*CALM WINDS* 3.36%

*NOTE: Frequencies indicate direction from which the wind is blowing.*

*WIND SPEED* ( MPH )



OhioEPA
State of Ohio Environmental Protection Agency
Northeast District Office
2110 E. Aurora Road
Twinsburg, Ohio 44087-1969
(216) 425-9171
FAX (216) 487-0769

George V. Voinovich
Governor

September 16, 1997

RE: Master Metals Site
Cuyahoga County
218-0501
Engineering Evaluation and Cost Analysis (EE/CA) Workplan

Mr. Thomas Alcamo
Remedial Project Manager
United States Environmental Protection Agency
77 West Jackson Blvd. Mail Code SR-6J
Chicago, IL 60604-3590

Dear Mr. Alcamo:

The Engineering Evaluation and Cost Analysis (EE/CA) Workplan for the Master Metals Site, Cleveland, Ohio, was received by this office on August 13, 1997. After review, the Ohio EPA would like to offer the following comments:

1) Section 3., Item #2; The text indicates that Boring B-31 is located outside any facility operations and found 229 mg/kg of total lead at five feet of depth. The document points out that the area has been filled with slag at depths of ten feet, and this background level is attributable to inorganics in the slag. However, several samples indicate that off-site samples in near proximity to the site were characteristically hazardous. The Ohio EPA would like to recommend that additional sampling around the site be incorporated in the EE/CA Support Sampling Plan.

2) Site drainage ways should be clearly defined and sampling of the waterways completed to evaluate the effect of site contaminants that have left the site. The Cuyahoga river and Lake Erie are heavily used for recreational boating and fishing. The risk to humans and animals from site contaminants or bioaccumulation should be defined.

3) On July 14, 1993, Ecology and Environment, Inc., performed off-site soil sampling at the Valleyview apartments and nearby baseball field. The analytical results of soil samples indicated lead concentrations up to 1,850 mg/kg. This number is well above the recommended removal level of 500 mg/kg. Additional samples in this area could provide more detailed information of the amount of risk to residents or recreational users.

Please evaluate these comments for the up coming drafting of the EE/CA Support Sampling Plan. Should you have any further comments or questions, please feel free to contact me.

Sincerely,

Joseph E. Trocchio

Joseph E. Trocchio
Environmental Engineer
Division of Emergency and Remedial Response

JT.wmk

cc: Bob Princic, DERR, NEDO